



*Fairfax County*  
**VIRGINIA**



## **SECTION 5**

**IT ARCHITECTURE**

# INFORMATION TECHNOLOGY ARCHITECTURE

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## SECTION 5

### INFORMATION TECHNOLOGY ARCHITECTURE

#### 5.1 ENTERPRISE ARCHITECTURE

This section of the Plan identifies the current information technology architecture implemented in Fairfax County. The County's technology architecture is a strategic asset that defines technology components necessary to support business operations and the infrastructure required for implementing new technologies in response to the changing needs of government business. It is a multi-layered architecture that includes IT architecture segments including:

- Application and Data Architectures
- Platform Architecture
- Network Architecture
- Internet Architecture
- Security Architecture

#### 5.2 IT ARCHITECTURE PROCESS MODEL

Enterprise Architecture (EA) is the blueprint or roadmap by which specific technology solutions are created. Architecture defines how technology is used to enable business solutions. It also must be flexible enough to allow expansion and change as requirements evolve or technology becomes obsolete or is updated. Architecture as a foundation and roadmap, also allows the county to understand how new requirements and technology changes will affect it and allows new technology opportunities to be captured as part of an updated blueprint to benefit others. EA improves the efficiency and effectiveness of technology investments by reducing redundancy and promoting the sharing of knowledge and best practices across county government.

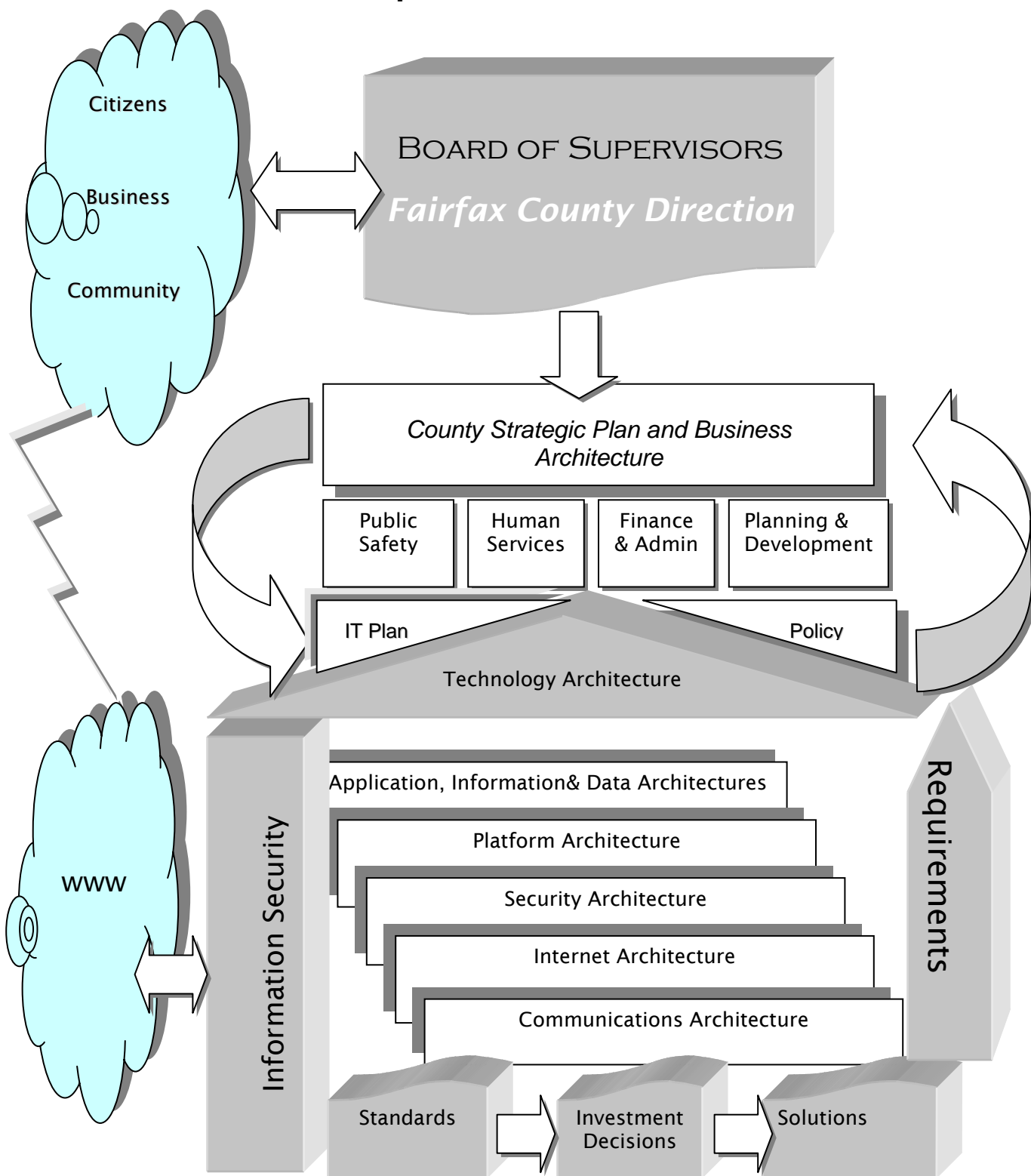
The Architecture Process Model on the following page illustrates the inter-relationships between the County's IT and business architectures, and the iterative processes involved to ensure the development of an IT architecture that is efficient, cost-effective and business driven. For the purposes of the County's model, the business processes have been grouped into four major functional areas; Human Services (HS), Public Safety (PS), Planning and Development (PD), and Finance & Revenue (F&R), which reflect the compartmentalization of County services for delivery as well as evaluation purposes.

The model is based on the mission statement for Information Technology, specifically:

***"Delivery of quality and innovative information technology solutions for agencies and those doing business with Fairfax County Government."***

This mission is what directs the County's information technology activities. Every effort undertaken is framed against this mission statement.

## Enterprise IT Architecture Model



## 5.3 APPLICATION & DATA ARCHITECTURE

The application architecture defines how applications are designed and how they cooperate. The architecture promotes common presentation standards and enables a high level of system integration, and storage and retrieval of data. It should facilitate the reuse of components and rapid deployment of applications in response to changing business requirements. This layer includes elements of the technology architecture that converts business process to business intelligence, the overall goal being to ensure that County services are executed in a timely, efficient and cost-effective manner. The County has a vast inventory of enterprise-wide and agency specific production applications residing on mainframe, mid-size computer and microcomputer platforms. New applications and application enhancements are constantly being evaluated, developed, acquired, and implemented as older "legacy" applications are retired.

The County's goal for this layer is to use and create industry standard application development tools and language environments that are adaptive in client/server and Web-enabled models. Further, this should allow the County to protect its investment in 'classic' systems by providing enhancements that facilitate greater user-friendliness, better data manipulation and reporting, and end user controls. In addition, by keeping abreast of emerging technologies such as Web Services, XML, and so forth, the County is positioning itself to take advantage of the opportunities these technologies offer. An exhaustive discussion is beyond the scope of this section; however, some examples of the County's application architecture and some recent developments are described here.

As the County moves toward finding a balance between COTS vs. in-house development, a new framework for development activity is being put in place. First and foremost, this new framework will incorporate the concepts of Software Engineering, Information Architecture, and Application Development Methodology. These principles and techniques will be used to augment the current Systems Development Life Cycle Standards (SD LCS). This approach will encompass application life cycles from "cradle to grave"; that is, from the earliest stages of planning, through requirements and design, to implementation and post-implementation support. These new applications will be built on the most current and promising platforms and an architectural framework based on the future of IT, not on the past. While existing legacy systems will continue to be supported, a dramatic move is also underway to embrace new development platforms such as .Net and emerging standards such as XML and Web Services.

The .Net platform will provide the foundation for the next generation of both departmental and enterprise-wide applications. .Net provides a stable application environment with more opportunity for componentization of business logic, sharing of common components and the integration of business processes across application boundaries. A new class of tools such as Visual Studio.Net will provide County developers with a robust and flexible development environment. Encapsulating both existing and new business logic into "Web services" will provide the ability to expose business processes across organizational and application boundaries, not only within the County, but with other jurisdictions, the state, and the federal government, as well as with business partners. XML will provide the common "glue" to hold together and provide consistent information across these boundaries to facilitate the need to share data from disparate platforms and systems. Enterprise Application Integration (EAI) products such as WebMethods will allow a virtually unlimited ability to share, and bring into this new environment, information and business process from older, mainframe and client/server applications. With the ability to extend these business processes even more through the use of ASP code, the result will be a product that is greater than the sum of the parts.

A detailed "Architectural Framework" document has been developed. The framework is intended to be an organic document which will be flexible enough to reflect and incorporate the rapid advances in information technology.

**Office Systems** - Fairfax County uses the MS Office Suite installed on PCs attached to LAN-based servers and printers to facilitate shared file and printing requirements for word processing, spreadsheet, groupware presentation software, workflow database applications, project management and collaborative group work

process and workflow. E-mail is MS Outlook on the desktop supported by Microsoft Exchange on a Unisys enterprise server.

**Production Applications** - Fairfax County is in the midst of overhauling and updating many of its administrative applications as well as acquiring new applications. Key applications in the midst of development or further enhancement include the County's land development systems, tax systems, public safety systems, various human services systems, and human resources management systems. DIT maintains approximately 65 mainframe-based classic applications for Fairfax County agencies that support finance, purchasing, personnel, public safety, and planning and development of business operations. The most are modified package software, that run under CICS, using programming language architectures such as COBOL, SAS and EASYTRIEVE PLUS, with DB2, IDMS and VSAM databases. Efforts are underway to convert IDMS based applications to new technology. The current mainframe ('enterprise server') is an IBM 9672 with 1.5 Terabytes of storage, running z/OS. Access to the mainframe systems is provided via the county's LAN by mainframe terminal emulation software on the desktop. The mainframe systems utilize text-based screens with user knowledge required of the application commands and function keys.

DIT has deployed Web-enabled GUI front-end versions of several mainframe applications to facilitate easier access to system data. In addition, the classic COTS financial suite had been enhanced through the use of the county's middleware EIA software tool, WebMethods which ties the two COTS together creating an integrated process for processing financial transactions with a modern user friendly Windows presentation. There are several projects underway to use EIA and Web-enable other corporate systems to build in webservices, work flow and desktop reporting capabilities, meeting end user demands for GUI access to County business data. DIT also provides first tier support for over 100 server-based applications for agencies that provide Windows GUI access to a server resident database. Most of the server applications are "fat client" in nature with ORACLE as the primary database residing on UNIX and/or Windows servers. Some of these are being upgraded to web-browser based applications.

There are also "fat client" and web server-based agency specific applications that are maintained separately by agency IT staff. The large majority of the small agency applications use Microsoft Access or Microsoft SQL Server as their database and programming language architecture. The IT standards call for complex, Internet accessible or high access databases to use Microsoft SQL Server, Oracle or DB2 as appropriate. Most agency server-based systems reside on Windows 2000 servers that support both applications and file and print server-sharing requirements. In FY 2005, the operating environment will migrate to Windows 2003.

**Geographical Information System Applications (GIS)** - GIS is a specialized system for storing, retrieving and analyzing an array of digitized map layers that collectively record the topographic, demographic and other features of every location in the County. GIS can be used to identify the shortest route from one location to another, generate school bus and sanitation truck routes, locate sewer lines and other utilities, plan development and many other useful tasks. Our system currently has over 200 layers of GIS data. The County is continuing to develop its GIS data and implement new applications in support of agency functions. GIS is supported on the UNIX platform.

### 5.3.1 The Application Tools

Application tools are the information technology components used to develop and support the functioning of the applications. Application tools also include the support systems used to facilitate work planning and communications.

**Programming/Development Tools** - New applications are currently being developed using fourth generation object oriented languages and tools. This approach will continue as additional client/server applications are developed and as Commercial-Off-The-Shelf (COTS) system components are purchased. Standard life-cycle methodologies are employed to define, develop and implement new systems. The models and design documents that are created are updated throughout the system development and maintenance life cycle. In



specific instances, expert system technology has been used to incorporate complex rule based functionality into systems. Third and fourth generation languages and tools are used in only a few specific development efforts and as utility programs on the mainframe tier of some client/server systems. New developments are using ASP and ASP.NET and *Dreamweaver* for the presentation layer. The County uses webMethods, a suite of tools to assist in the integration of applications at the presentation, business logic, and data layers. Documentum is the county's enterprise content and document management software solution. The county also supports REAMS imaging solution. Software Engineering technologies are being incorporated into the Systems Development Life Cycle Standards (SD LCS) to provide a disciplined and consistent development approach.

**Database Management Systems (DBMS)** – The County uses several database management systems to support its business applications. Mainframe classic and legacy applications use DB2, IDMS, and/or VSAM databases. DB2 is the preferred database solution for new mainframe hosted applications. For UNIX or Windows platforms, Oracle and Microsoft SQL Server are the County's database standards. Oracle Gateway, Neon's Shadow Direct, and webMethods are used to enable access of mainframe DB2 databases. Crystal, QMF, SAS, and Easytrieve Plus support ad-hoc query and reporting. Relational database design activities, such as creating entity-relationship diagrams, the data dictionary, the process models, the logical and physical data models, and the database definition language, are supported through the COOL: BIZ and ERWIN tools.

**Office Automation/Workstation Software** - The County office automation tools are the Microsoft Office Suite including Word for word processing, Excel for spreadsheets, PowerPoint for presentations, Access for desktop application databases, Exchange/Outlook for e-mail/groupware, and Internet Explorer for Web browsing. Other desktop software used includes Microsoft Project for project management/tracking, VISIO, and Symantec AntiVirus. Agencies may have other desktop based software for special requirements.

**GroupWare/Collaborative Software** - The County uses Group Systems as its primary collaborative group software in the Group Decision Support Center. Groups use the computer-supported meeting center and its software to conduct process improvements, strategic planning, program evaluation, and vendor selection sessions. Other software is used to support activities dealing with the group output/results, e.g., Microsoft Exchange, Word, Excel, databases, presentation and process modeling software.

**GIS Software** - The ARC/INFO software provides high-end workstation tools and functionality to the GIS analyst. The software integrates visual or graphic data in the form of maps, with descriptive or attribute information from an organization's internal databases. ARC/INFO provides the tools for analysts to access, visualize, and query both graphic and tabular data for better analysis and decision-making. Additionally, ArcView GIS provides mid-range desktop GIS tools to the skilled-user for map creation and analysis of the County's geographic data sets. And finally, MapObjects and the Internet Map Server provide a method for distributing highly customized GIS based applications through the Internet /Intranet.

**Technical Support Center-Help Desk Software** - The Technical Support Center provides County employees a centralized point of contact for computer support. Using the Automatic Call Distribution telephone system to route calls and diagnostic tools such as ServiceWare Knowledge Paks, Microsoft Technet and technical documentation, the Technical Support Center has a high percentage rate of first call resolution. The client/server application Quintus CustomerQ, WebQ, the Intranet counterpart, and the Oracle database are accessed through the County's Enterprise System.

## 5.4 PLATFORM ARCHITECTURE

The platform architecture defines the technical components of the infrastructure including client and server platforms, the operating systems and interfaces supported, and equipment used to operate the applications and application tools. Fairfax County's platform architecture includes over 300 servers: z/OS mainframe, UNIX (IBM

AIX and Sun Solaris), and Microsoft Windows 2000/2003. Over 10,000 PC's provide end-user access to County systems. Laptops, Palm Pilots, Blackberries and other PDAs and hand-held devices also support employee access to Agency business systems.

All Personal Computers use Windows 2000 or Windows XP and the Microsoft Office Suite to support office automation requirements. Total server storage requirements have grown from 394 gigabytes in 1998 to the current total of 22 terabytes. The County also uses state and other non-County hardware platforms as necessary. The following paragraphs describe the major features of the County's platform architecture.

## 5.4.1 The Platforms

**Desktop PCs, Workstations and Peripherals** - Increased use of microcomputer technology by all Fairfax County agencies has facilitated the streamlining of operations and improved the delivery of services to citizens. DIT prescribes hardware platforms and desktop applications standards and procurement vehicles as a means of controlling costs. Standard desktop configurations allow for consolidated procurement and enhance the County's ability to provide technical support to all users. Desktop microcomputers (PCs) are replaced in accordance with the County's four-year PC Replacement Program cycle using the standards that are available and adopted at the time. All County microcomputers and associated peripherals are centrally procured to achieve economies of scale, consistent hardware platforms throughout all agencies creating a more effective support environment.

The current microcomputer platform standard consists of mostly Pentium based hardware running the Microsoft Windows 2000 operating system. County microcomputers are used for office productivity software, enterprise e-mail and groupware, application client software, Internet/Web access, and mainframe emulation. Office configuration standards are depicted in the diagram on the next page followed by a table listing all County IT Standards for desktops and servers. The next wave of PC replacements deployed during FY 05 will be using Pentium with the Windows XP operating system. This will be approximately two-thirds of the installed base.

Desktop and network printing is accomplished through a large inventory of stand-alone and network printers. Mainframe output is generated on two variable speed impact printers that support 2,000 to 4,000 lines per minute, and two advanced function printers that operate at speeds of up to 310 pages per minute. Agencies use a variety of laser-jet type desktop and high speed LAN based printers in offices.

In 2003, the county's copier inventory became an enterprise multi-function copier/printer/scan/fax machine asset. In FY 2005, this program was moved to the Department of Information Technology and incorporated into an enterprise printing solution strategy.

**LAN-based Network Servers** - Fairfax County has completed the migration to its new LAN directory services standard, Active Directory, which is an essential component of the Microsoft Windows 2000 architecture. However, the County still supports Microsoft Windows NT Server for required applications. In addition to the current NT and Windows 2000 servers the County also supports UNIX servers that are used for those large agency specific applications that require a more robust server platform. SUN is the preferred UNIX server; however, the IBM p-Series is still supported.

CITRIX Meta Frame Servers are used for many of the business applications that require "thin-client" technology to minimize Wide Area Network traffic, optimize the efficiency of fat client-server applications, and streamline desktop PC support activities. CITRIX also support secure access for remote access users and telework.



Details on managed LAN-based servers:

<b>Mid range Platform</b>	<b>Number of Servers</b>
AIX	12
W2K/W3K	320
Solaris	25
Unisys	1 (x 24)

**Mainframe (Enterprise Server)** - Fairfax County supports its major business and legacy applications on an IBM mainframe running the z/OS operating system. It is partitioned into logical machines, serving over 20,000 agency and schools users at over 200 locations.

<b>Device</b>	<b>Machine</b>
Mainframe Computer	IBM 9672-R26-CMOS 3 GB real & expanded memory
Tape Subsystem	IBM 3494 Automated Tape Library IBM 3590E Drives IBM 3480 (cartridge)
Printers	IBM 4100 Laser IBM 3900 Laser IBM 6400 Line Matrix

## 5.4.2 Storage Area Network

In FY 02 Fairfax County began its first implementation of the Storage Area Network (SAN) infrastructure. The initial purchase was eight Terabytes of Hitachi Data System (HDS) storage. Since that time, the HDS has been expanded to 34 Terabytes. During FY 05, the County added EMC storage to the existing SAN infrastructure and meet the strategic initiatives for Data Life Cycle Management. Platforms connected to the SAN include the mainframe server, Windows servers, and AIX and Solaris servers. The primary SAN benefit is enabling server access to a centralized pool of storage, thus providing administrators with greater flexibility in realigning storage capacity to the servers that need it.

Storage Management requirements addressed by the SAN are:

- Scalable storage capacity that can allow users to increase their storage as needed.
- Modular, adaptive architectures that allow users to deploy storage in a variety of centralized and distributed environments with re-deployment capabilities when needed.
- Highly available architectures to prevent downtime.
- Cross-platform solutions that support a variety of operating systems, allowing users to reduce costs by standardizing on a single enterprise storage solution, rather than operating system specific solutions.
- Higher levels of performance to support the ever-growing amounts of data that are being put online.
- Higher performance backup and restore operations to support shrinking backup windows.
- The ability to share data across the enterprise rather than building "islands of data."
- Management tools that are easy to use and centralized while allowing the hardware and data to be "distributed."

Storage Area Network Details:

<i>Device</i>	<i>Machine</i>
Disk Subsystem- Intel & Unix	Hitachi 9960
MS Exchange environment	EMC2
Tape Subsystem	IBM 3494 Automated Tape Library IBM 3590E Drives Spectra Logic 64K Tape Library

## 5.5 NETWORK ARCHITECTURE

The County's communications infrastructure includes voice and data technologies and the various topologies, transmission services and protocols necessary to facilitate the interconnection of server platforms, intra-building and office networks (LANs), and inter-building and campus networks (WANs). The County's voice and data networks continue to grow, in terms of cost, sophistication, and increased demand on our communication staff.

The Communication Group in DIT supports over 12,500 data ports and over 15,000 voice ports. Additionally, initiatives already in place and those planned have resulted in many significant changes with many more occurring in the future. The Gartner Research Group and others now document that network technologies refresh every 18-24 months. This will provide more challenges for County fiscal and staff resources, as the County strives to keep network standards in line with evolving business requirements, security and other

support needs. The communications plan strives to take into account growth, based on the needs of County agencies as programs expand, which in turn require new or expanded network resources to provide both intra and inter County links. The Internet and Web-enabled applications have rapidly expanded. This expansion and the need for business continuity required the expansion from a single high capacity DS3 to two full 45 Mbps circuits connected to two separate ISPs. Future initiatives and technologies, such as e-Government applications, streaming video, teleconferencing, and more integrated and complex applications drive the requirements for the County's communication infrastructure and its components, thus the requirement to update and/or enhance annually. During FY 2004 the County replaced its Wide Area Frame Relay network with a new ATM logically meshed network. The desire for increased network security has resulted in the County employing Network Address Translation (NAT) to add another security layer to protect its Enterprise Network.

The goal is to provide a network that is responsive and reliable for the user and the user's application and will allow for the uninterrupted flow of voice, data, and video information. To this end, the County is working on several projects that will boost and consolidate the underlying physical infrastructure supporting voice, data, and video, while at the same time providing increased, cost-effective bandwidth potential, and improved output. The best opportunity recognized is through the implementation of the I-NET, a metropolitan fiber ring that will connect over 400 County and Schools facilities. The County views a strong, viable communications infrastructure as a vital component in the overall IT strategy toward maintaining its success in deploying cost-effective solutions that optimizes its business goals, and maintains its reputation as a leader in technology.

### 5.5.1 Enterprise Data Communications Network

The Enterprise Data Communications Network for Fairfax County Government serves as the data communications backbone that provides countywide access to information technology resources. Operated by the Department of Information Technology Infrastructure Division, the Enterprise Data Network connects approximately 12,500 computer devices in over 300 locations. These computer devices include personal computers, printers, network servers, communications equipment (routers and switches), modems, UNIX workstations and servers, mini-computers, and the mainframe computer. Additionally, various wireless technologies are rapidly expanding throughout the County's network.

All supported network systems are based upon open standards, and compliance with published standards is required for any network-connected device or system. Therefore, although the Enterprise Network supports equipment and systems from multiple vendors, the County has implemented a pure TCP/IP network protocol. Gigabit Ethernet is used as the backbone at both the Government Center and Public Safety campuses. Each of the two Campuses are connected via an OC12 and the standard desktop connection is switched 100 MB.

The Enterprise Wide Area Network (WAN) Architecture for Fairfax County is ATM. The WAN backbone consists of two OC-12 (622 MBPS) circuits into the Government Center and Public Safety campuses providing redundant fully meshed trunks for the remote sites. At the remote sites there is a mixture of ATM OC-3s, DS3s and full T1 service, with no site having less than full T-1 capacity. This new WAN architecture provides redundancy to all remote sites including the Public Safety Campus and has a highly sophisticated perimeter and internal security implementations to protect the County's electronic information. This new network design, including a renumbering scheme, security implementations and equipment, will permit the overlay of the network onto the new I-Net as that topology is implemented.

The County also utilizes both ISDN and DSL technologies for small sites such as Group Homes and Park Maintenance shops. The decision to use these technologies is based on staff size and data requirements of the staff. Currently, the County maintains 47 ISDN sites and 10 DSL sites.

An addition to the Enterprise Wide Area Network (WAN) Architecture during FY 05 was the creation of a Public Access Network. The purpose of this network is to provide public access computers to the Citizens of Fairfax

County allowing them access to County and Internet resources while protecting the Fairfax County Enterprise Network. This network includes all Public Libraries and Community and Recreation Services sites. The design provides for separate physical networks at each site while sharing the existing WAN infrastructure and using logical separation on the WAN. A Firewall between the Enterprise Network and Public Access Network allows for County IT staff to manage the infrastructure down to the desktop for each site. This model will continue to be followed at any new facilities requiring both enterprise and public access.

Network Management is currently supported on four platforms:

1. IBM Netview for MVS – Monitors mainframe and network resources,
2. CISCO Works 2000 – Monitors all Cisco installed equipment.
3. Orion Solarwinds -- used to track performance issues
4. Verizon Managed Services – provides fault reporting of all ATM sites.

Currently, mainframe connectivity is achieved through two primary gateways. The first, a Cisco router using CIP (Channel Interface Processor), connects directly to the IBM Mainframe through a fiber-optic channel and supports a majority of the TN3270 (Telnet) sessions to the mainframe; the second, an IBM 3745 Communications Controller used to support the legacy SNA networks, which provides low speed mainframe only network connections to several remote sites.

Beginning in FY 2005 and continuing in FY 2006 is the redesign of the Enterprise Network Perimeter. The County has implemented a 'SAFE' architecture dividing our perimeter into four business groups E-Commerce, Internet Access, Partners, and Public Access. Each group has its own physical firewall tailored for that specific business area. The E-Commerce business group supports all public facing web services providing access to County resources for both Citizens and Businesses. The Internet business group is used to control County employee access to the internet and allow for content and virus scanning. The Partners business group allows for connections to external "Trusted Partners" to include Fairfax County Public Schools, Fairfax County Water Authority, Commonwealth of Virginia (State Police, State Health, Department of Social Services, Supreme Court, Department of Juvenile Justice, and State Board of Elections) as well as connections for several adjoining jurisdictions for public safety. By doing so the County has increased Firewall performance and limited exposure to each business group.

During the next two years, the County will light the dark fiber provided by Cox Communications through the Cable Franchise Agreement to support data, voice and video communication to County and School facilities. Remote access via dial-up, VPN, and Citrix services provides access to the County's Enterprise Network resources for telecommuters, vendors, remote access users, or business travelers, as well as several small Fairfax County offices. Security for remote access is managed through a Remote Access Server using security tokens and PIN numbers. During FY 2005 the County will continue to implement wireless LANs and wireless data over cellular systems, when this technology makes good business sense. The County carefully evaluates the use of this technology to ensure all County data is protected from unauthorized access. As Voice Over Internet Protocol (VOIP) solutions become more mainstream, the County will start prototyping these solutions in those locations to which it makes both business and fiscal sense.

## 5.5.2 Voice Communications Network

The County's Voice Communications Network provides voice communications services to all Fairfax County Government agencies, as well as various affiliates via County-owned PBX's, Centrex's, and key systems which are located in buildings throughout the County and connected via Telephone Company lines and several direct County-owned lines for campus locations. The services range from small to large call centers, IVR (Interactive Voice Response) systems, complicated voice services, and residential services for County-operated group

homes and apartments. Management and voice communication support are also provided for the primary and backup (alternate) 911 communications centers.

Although the convergence of voice, data and video traffic into a single network is the ultimate goal for the County's communication architecture, the County currently uses a mix of digital, analog and hybrid PBXs, digital electronic key systems, analog 1A2 Key equipment, Verizon provided Centrex, and single-line (POTS) equipment to meet its voice communication requirements. There are approximately 400 manned County locations, comprised of two major campus environments, several large Human Services centers, Parks, Libraries, Police, Fire and Rescue stations, "911" Centers, Public Health Centers, etc. Additionally, the County has links to over 300 unmanned water, sewage and HVAC systems, as well as links to various agencies of the Commonwealth of Virginia and other local jurisdictions. The county developed a strategic plan for replacing these disparate systems with an enterprise-wide voice communications solution. Implementation of the new voice solution will begin in FY 2006. The solution will use the latest technology that includes VOIP and will use the I-Net (fiber-optic network) as the backbone network that connects county facilities and will lower the County's circuit costs.

DIT supports over 15,000 phones, which use a combination of Siemens/Rolm, Toshiba, Avaya, Mitel and Norstar systems. During an average month the County places over 1.3 million calls excluding intra-building calls. Below is a brief, but by no means complete, summary of the County's voice communications infrastructure.

- The main government centers and large buildings are serviced by Siemens PBXs and Nortel Meridian Option 61C PBX systems; all having integrated voicemail systems.
- Fairfax County's main Government Center's voice traffic is served with a four-node Siemens 9751-70 and the County's Public Safety Center located at the Massey campus with a two-node Siemens 9751-70. These systems, as well as several other large building systems are interconnected via DS1 tie lines, which reduce some of the message unit charges from Verizon.
- An IP-enabled Nortel PBX is located at the South County Government Center and supports an office two miles away via a remote shelf. About 10% of the telephones are IP sets.
- A Nortel PBX is located at the PSCC (Public Safety Communications Center) for emergency calls, while administrative calls at this location are processed by a Nortel Succession 1000 PBX, which replaced the aging System 75 PBX.
- Voice communications to our smaller remote sites, including Libraries, Parks, Public Health Centers, etc., are served by various Toshiba systems and Siemens "Redwood" systems, all with integrated voicemail. The County also has one recently upgraded Mitel SX-200.
- A Nortel Networks Succession 1000M has been installed at the Health Department's Kelly Square location. This IP enabled PBX not only gave the department advanced capabilities, but it also took a significant resource load off the Massey PBX.
- Police and Fire and Rescue stations are all being upgraded to Nortel BCMs and are networked to a Succession 1000M configured as a Network Gateway Controller. This will allow Public Health and Public Safety personnel, located in different buildings across the County, to be integrated into a contiguous "First Responders" telephone network.
- A ninety-six (96) port computerized conference bridge is located at the PSCC for predominately Police and Fire and Rescue operations. This conference bridge is provided by Octave, and is expandable to 192 ports.
- Voice needs of our very small offices, i.e., small Human Services and community services sites are supported by POTS service and single-line analog sets.
- Various agencies also use centralized IVR services with connectivity provided via Verizon T-1 and numerous channel banks at distant sites. These services have greatly improved Fairfax County government's ability to provide quality services to its citizens and business clientele.

- The County's antiquated VDS hardware and software used to capture ACD historical statistics has been replaced with new hardware and a new application which provides Call Center statistics and metrics. Although not a final solution this application will greatly improve the necessary statistics used by our Call Center managers to evaluate the County's response to County citizens.
- The County's 12-year old ATMS (Automated Telephone Management System) has been replaced by a new ACECOM NetPlus management system which will significantly improve the management of the County's telephony systems and dramatically improve our inventory, work order, and billing processes.

A framework for a strategic direction to evolve the Counties communications capabilities and services was developed during a FY 2002 comprehensive study of the telecommunications architecture, including support issues, unique applications, and opportunities made available through the I-Net. FY 2005 will see the expansion of this strategic plan into tactical programs and implementation plans. These plans and programs will help the County to meet the telephony needs and requirements of our citizens and employees. By leveraging the high speed – high bandwidth connectivity provided by the County's new fiber-optic network – I-Net, Fairfax County will have a fully integrated video, data and telephony Enterprise.

### 5.5.3 Emergency Communications Network

The emergency communications networks that the County maintains are divided into two categories: Public Safety Radio Network and Public Service Radio Network.

#### **PUBLIC SAFETY RADIO NETWORK**

**Voice Network** - The County operates a digital, 800MHz trunked voice radio system that supports the operations of the Police, Fire and Rescue, and Sheriff's Departments, with more than 3,000 mobile and portable radios. This system infrastructure is also utilized by the County's Public Schools Security Department, and by the independent police department of the City of Fairfax, and the Towns of Herndon and Vienna. Equipment is located at nine locations throughout the county, and all sites are linked together by a redundant VERIZON SONET network. The system provides for voice interoperability with and between the public safety agencies of Arlington County, City of Alexandria, Metropolitan Washington Airports Authority, City of Manassas, City of Manassas Park, as well as the District of Columbia Fire Department. The public safety agencies of Loudoun County, Prince William County, and Montgomery County will be added to the interoperability compatibility as they activate their own new radio systems. Fairfax County is expanding this public safety radio system by adding three additional tower site locations to be completed in FY 2005.

**Mobile Data Network** - To support operations of the various public safety agencies, the County operates a 450MHz mobile data communications system (MDCS) that ties the response vehicles of the Police, Fire and Rescue and Sheriff's departments to the County's Computer-Aided Dispatch (CAD) system, as well as access to various databases maintained by the Commonwealth of Virginia and the Federal Bureau of Investigation. This system consists of more than 900 Mobile Computer Terminals (MCT) and Vehicular Radio Modems (VRM) in vehicles of the various agencies, with transmitting equipment located at six sites in the County.

#### **PUBLIC SERVICE RADIO NETWORK**

The County currently operates a 1980s-era trunked radio system of more than 3,000 mobile and portable radio for the Department of Public Works and Environmental Services, Public Schools Transportation (school bus fleet), Park Authority, Water Authority, FASTRAN, and other non-public safety County agencies. This current zoned radio system consists of two transmitter sites in Fairfax City and in Lorton. The County is replacing this outdated radio system, which has insufficient geographical coverage to meet user requirements, with a state-of-the-art, 800MHz analog trunked radio system. The system design consists of seven tower site locations, and will provide additional capacity to users and a "seamless" environment, which will not require County vehicles to



change channels as they move through radio zones. This system replacement was implemented during FY 2005.

## 5.5.4 Institutional Network (I-Net)

This fiber optic network will arguably become the most cost-effective, viable, and lucrative technological advance the County has experienced since computers first appeared in the County's technology inventory. This fiber optic network will provide virtually "unlimited" bandwidth to meet the County's present and future communication network requirements. It will truly become the "super highway" for the County's internal video, voice and data communication network. Although broadband is available through local telecommunication companies, it comes at a significant price, a loss of flexibility, and for some services, only limited availability. The I-Net's "unlimited" bandwidth, albeit with some significant upfront cost, will allow the County to amortize its cost over the life of the I-Net with an overall cost savings.

The County's I-Net fiber network infrastructure will provide broadband capabilities that will transport data, voice and video communications directly to the desktop facilitating high speed data communications, Voice over IP services, video broadcast, videoconferences, streaming video, and distance learning (for example). It will be through this I-Net that the County will truly reach its ultimate goal of converged voice, data and video technologies. The network will have several origination points, and a facility for programming or controlling the switching and routing of data, voice and video signals among all participating sites.

### **I-Net Voice/Data Service**

As with the video world, the I-Net fiber network will provide greater capability for the County's voice and data networks and will allow the County to reach its goal of a truly "transparent" network. The I-Net's broadband capabilities will allow running voice and data services over a single network infrastructure (versus traditional separated networks), and, enhance our Voice over IP services and permit IPTV, videoconferences, and streaming video directly to the desktop. Convergence of our existing voice communications to VoIP and IP telephony will allow the County to reach its long term goal of restructuring its dialing plan to include five digit dialing to and from any County facility and eliminate current packet charges between sites. Additionally, the integration of voice and data paves the way for further County-wide productivity through applications such as: Unified Messaging, integration of the phone system with Exchange/Outlook's address book, Call Center Management, etc.

It should be noted that although the I-Net is envisioned to result in considerable cost savings by replacing a significant portion of the County's Wide Area data Network and intra-County voice circuits, some existing data and voice circuits will remain for backup and redundancy, as well as to meet special functions, such as the 9-1-1 Center and the Emergency Operations Center. In FY 2006, the project team will begin lighting the I-Net fiber and migrating the current network to the I-Net infrastructure.

### **I-Net Video Network**

The County's I-Net fiber network infrastructure will provide broadband capabilities that will transport video communications directly to the desktop facilitating broadcast, videoconferences, and distance learning. The network will have several origination points, and a facility for programming or controlling the switching and routing of video signals among all participating sites. The network will be able to carry signals that can be converted to and from analog video. The video performance characteristics should meet or exceed those established by FCC Standards (Part 73.699) for broadcast video transmission. The network could include telemetry facilities for remotely controlling and adjusting video equipment for such functions as panning, tilting, zooming, and adjusting the lighting. Finally, the network may contain a centrally administered signal security capable of restricting video and audio reception to designated sites.

## 5.6 INTERNET ARCHITECTURE (E-GOVERNMENT)

The Fairfax County Internet architecture provides significant and wide-ranging opportunities to utilize emerging technology as a means to make information more readily available to County staff, citizens, and businesses. In addition, the interactive nature of the technology allows residents and others to conduct business (e.g., pay taxes, apply for permits, etc.) with the County at their convenience and from their location. Likewise, Internet technology allows access to enterprise data (real estate assessments, Human Services resource database, etc) without the need for a resident to call or visit the County Government center complex.

The e-Government architecture defines the standards, technologies and guidelines for public access, and conducting electronic business among County agencies, state agencies and outside entities. The County's Internet architecture is/will be comprised of the following:

- **High Speed Connection to the Internet** - The County's fractional DS-3 connections to the Internet. This provides access to the Internet for County staff as well as outside access to the County's Web server(s) by residents, business, and others via the Internet.
- **Public Access Web Server** - The County's Public Access Web Server provides Internet users with a vast amount of information made available by various agencies within the County. The Web server can be viewed as an "on-line service counter" where residents and others may obtain information related to services, licenses, taxes, recreation, court filings, and so on. The Web server also acts as the distribution or collection point for information obtained from or provided to enterprise databases via an "Application Server."
- **Intranet Web Server** - The County InfoWeb Intranet Web server provides the same type of facilities but access is limited to County staff.
- **Application Servers** - provide the gateway between the County Web servers and the information stored in County enterprise databases. The application servers do the work of communicating with various databases on the County mainframe and other platforms, accessing and collecting the requested information, formatting the information in the appropriate way, updating the database where appropriate, and returning the result to the Web server for dissemination to the requestor. Application servers also provide additional levels of security to ensure that only allowable information is accessible.
- **The WebBoard Server(s)** - provide a mechanism for visitors to the County site to engage in ongoing discussions in either "real time" chat or, more commonly, by use of a localized version of Internet "newsgroup-style" discussion forums. These forums provide residents the opportunity to discuss a range of topics among themselves as well as with County officials and staff.
- **Interfaces** - between the County Application servers and the enterprise databases provide the link that allows access to data residing in a wide array of sources. The interfaces make it possible to access data from virtually all of the County databases: DB2, IDMS, VSAM, Oracle, MS Access, Paradox, and so on. The interfaces are comprised of "Application Program Interfaces" (APIs), Open DataBase Connection (ODBC), and other products that provide the access layer for the architecture.

## 5.7 SECURITY ARCHITECTURE

The Information Security Office defines the security standards and policies necessary to protect the information assets of the County. The Security layer employs security principles coupled with a hardware and software infrastructure supported with applicable policies, plans and procedures. This architecture is designed to provide an appropriate level of protection for all County information processing resources regardless of platform. The objectives of the information protection program are to ensure confidentiality of information, integrity of data, systems and operations, technical compliance for HIPAA, privacy and to ensure availability of information

processing resources. The basic elements of identification and authentication, access control and monitoring of information processing activities are employed throughout the enterprise.

In view of the dynamic environment of information technology, the security architecture continues to evolve to meet the challenges arising with new technologies necessary to conduct e-Government activities. Identification and authentication, access control, and auditing functions are performed on the specific platforms using the capabilities inherent in the appropriate operating system. Software, hardware and processes are continually evaluated to modernize the infrastructure to permit the County to participate in e-Government activities while still providing secure access to County resources. Fairfax County has begun implementing a more secure network architecture that takes a greater defense-in-depth approach to network security design. A method of network partitioning and the development of a modular perimeter infrastructure, based on the Cisco "Safe Architecture" are being deployed to better shield important resources within the network. In the creation of these partitions, the County's information technology assets will be designed and configured with specific security requirements based upon their level of trust.

Firewall technology is used as the main perimeter defense with all access from the Internet routed through the County's system of firewalls. In addition, the County uses broad filtering and routing at the firewall portion nearest the Internet connectivity, while more granular filtering and routing is exercised nearest the internal network connection. Classic authentication for each internal user is based upon a unique UserID (also called a sign-on or log-on) combined with a unique password. To improve the secure access and authentication to web-based applications as well as backend servers, the County has procured products from Netegrity. These products provide a solution that resolves today's security issues and positions DIT to leverage this investment and framework in the future to build upon and resolve other critical access control and user administration issues within our heterogeneous system environment. Netegrity, through its SiteMinder module, provides a software platform of shared services that includes reduced sign-on, authentication management (who are you), and entitlement management (what are you allowed to do on the site) for web-based applications. Netegrity also provides a secure reverse proxy solution that passes requests to enterprise backend content servers, and returns resources to the requesting client, thus allowing for a practical solution to the protection of internal assets. With Identity Management also being put in place, the County will be in a position to manage user profiles for both internal staff and public access, making personalized e-Government a reality. Netegrity will continue to be expanded to provide and user access authentication platform for internal and external users.

The County's network employs a private/public network model. Sensitive and critical assets are located on the private portion of the network while information and services available for public use are located on the public section. In FY 2005, DIT will continue implementation of modularized, multiple firewalls supporting a variety of specialized application requirements.

The County provides Dial-Up, VPN and Web Access technologies for our remote users. Each of these requires security tokens and LDAP authentication for access. Remote access is approved at the same level as if the user were physically at his or her work site. Remote access is granted to those individuals who are approved telecommuters, users who periodically need to access County Systems from home or other locations, and individuals who need access while traveling.

The County has also implemented an Intrusion Detection System to detect intrusions within the network. Security devices are able to detect signs of an intrusion or an intrusion attempt. Information necessary to detect intrusions are analyzed and reviewed in order to determine if sensitive data, systems or the network is being attacked or if a breach in confidentiality, integrity, or availability has occurred. The primary objective of enterprise security monitoring is to reduce the window of time-to-discovery. With the large quantities of log and alarm data generated by firewalls and sensors, the need for a specialized application to support the role of correlation was chosen. This solution conducts a comprehensive threat assessment and allows for quick identification and drill down of credible threats to the organization in order to expedite detection and response to intrusions.

Security will continue to be a fundamental component of the County's e-business strategy. Fairfax County's secure network architecture takes a greater defense-in-depth approach to network security design. A method of network partitioning and the development of a modular perimeter infrastructure are being deployed to better shield important resources within the network. This modularity achieves the ability to control the traffic that flows

to and from one area of the network to any other. In the process of creating these partitions, the County information technology assets utilized will be designed and configured with specific security requirements based upon their level of trust in order to serve specific purposes.